under the face and the right arm straight down. Both were probably female, and upon the breast of one was a fine bronze pin seven inches long with three pendant ornaments, and three discs of bronze, one plated with gold. Other bronzes of great interest were found with the second skeleton.

I do not write to describe the bones and ornaments, but to make public the conduct of the Luton authority. A most intelligent workman lives close to the site of the discovery—one Thomas Cumberland—a man who has studied the antiquities of the district for many years, and to whom antiquaries are indebted for great and freely given assistance. This man was on the spot at once, and clearly and correctly stated the age of the bones and ornaments as British or late Celtic. Notwithstanding this information, the local police insisted on an inquest, although the bones were broken to pieces and in the highest degree friable. I went to the nursery and confirmed Mr. Cumberland's determination, made drawings of the bronzes, and such an examination of the bones as circumstances would permit. The coroner refused to hold an inquest, and so had no authority to make any order, but he wrote and "suggested" that the bones should be buried in the parish churchyard. Armed with this "suggestion," the relieving officer ordered an undertaker to carry off the bones, which he did, in spite of the protest of the nurseryman, who informed him that they had been given to me and were my property. He was ordered to put the bones in coffins and bury them in the churchyard of Biscot. The undertaker took the bones to his shop at Luton. I at once applied to the relieving officer for permission to examine and measure some of the bones. I clearly explained to him the nature and importance of the discovery, and the trifling nature of the favour asked. This official replied in a curt and rude manner, and simply said, "I have no authority; you must apply to the coroner."

I repeatedly wrote to the undertaker to delay the funeral for a few days. I twice wrote to the coroner in an urgent but most respectful manner, and pointed out the importance of the discovery, which, indeed, is quite unique in this district, but all to no purpose. He said he had not given the "order" for burial, and he refused to interfere, but he wrote to the undertaker and said, "I can give no consent or authority in any way, but must leave you to carry out the arrangement which has been come to with you." I wrote letters for six days to the different persons concerned, but to no effect; they would have a funeral, and the police now actually demanded the bronzes from the owner. The property is freehold.

Well, on Wednesday last the two coffins were screwed up at Luton and taken in a hearse to Biscot churchyard, where the vicar, in the presence of a policeman, officiated. Shining breastplates were screwed on to the coffins inscribed, "Bones found at Leagrave, July 1905." Amongst the bones in the coffins were several non-human examples, a rib bone of a sheep, a piece of a rib of beef, a bone of a rabbit, and another of roebuck.

Dunstable. WORTHINGTON G. SMITH.

Graphical Solution of Cubic and Quartic Equations.

SOME years ago you published some interesting communications in regard to the graphical solution of cubic and quartic equations (vol. lxi. p. 55, vol. lxiii. pp. 515 and 609, vol. lxiv. p. 5). The solutions then given give only the real roots of the equation. I therefore take the liberty of directing attention to the following method, which gives the roots of cubic and quartic equations whether the roots are real or complex, and may be applied to equations of higher degree, with more complicated results.

A cubic equation with real coefficients may be reduced by a simple real transformation to the form

$$z^3+qz+1=0,$$

where q is real, and since the sum of the roots of this equation is zero, they may be written in the form

$$-2y$$
$$y+\sqrt{x}$$
$$y-\sqrt{x}.$$

If, now, we form the symmetric functions, we have

$$3y^2+x=-q$$
$$2(y^3-xy)=1.$$

Hence if we draw the fixed curve

$$y^3-xy-\tfrac{1}{2}=0,$$

the coordinates of the points where it is cut by the movable parabola

$$3y^2+x+q=0$$

give the roots of the equation

$$z^3+qz+1=0,$$

i.e. if x_0 and y_0 are the coordinates of any such point, $-2y_0$ and $y_0\pm\sqrt{x_0}$ are the roots of the given equation.

In like manner a quartic equation with real coefficients may be put into the form

$$z^4+qz^2+z+s=0,$$

where q and s are real, and its roots may be put into the form

$$v\pm\sqrt{w_1}$$
$$-v\pm\sqrt{w_2}$$

and, forming the symmetric functions, we have

$$2v^2+w_1+w_2=-q \quad \ldots\ldots\ldots\ldots (1)$$
$$2v(w_1-w_2)=-1 \quad \ldots\ldots\ldots\ldots (2)$$
$$v^4-(w_1+w_2)v^2+w_1w_2=s \quad \ldots\ldots\ldots\ldots (3)$$

and if we put

$$4v^2=y$$
$$(w_1-w_2)^2=x$$

we find by simple elimination

$$xy=1,\ (y+q)^2-(x+4s)=0.$$

Hence the intersections of the fixed hyperbola with the movable parabola give values for x and y from which v, w_1, and w_2 may be calculated.

If we eliminate x from the two equations last written, we have

$$y^3+2qy^2+q^2y-4sy-1=0.$$

Hence there is always at least one positive value for y, therefore a real value of v; also, since $xy=1$, a positive value for x, therefore a real value for w_1-w_2; and since from (1) w_1+w_2 is real, real values for w_1 and w_2.

H. IVAH THOMSEN.

1928 Mt. Royal Terrace, Baltimore, Md., June 7.

THE PRESENT POSITION OF THE CANCER PROBLEM.

THE term "cancer" is in common parlance indiscriminately applied to all tumours the growth of which is unlimited and generally rapid, which tend to recur after removal by operation, and particularly which reproduce their like (the secondary or metastatic growths) in parts of the body remote from the original seat of disease. Pathologically there are various forms of "cancer," or malignant disease, but there is no need to deal with these here, and it may be stated that there is no sharp line of demarcation between the so-called benign and the malignant growths; there is a series of connecting links between the two. Malignant disease is an important cause of death. According to the last published report of the Registrar General (1903), the death-rate from this cause per 1000 living was 0.87; for comparison that for pulmonary tuberculosis (consumption) may be quoted; this was 1.2.

Moreover, it is a common belief that cancer is on the increase; people remark how much more frequently it is heard of now than formerly, and apparently the statistics support this view, for the cancer death-rate, which was 0.56 in 1884, has steadily increased, and is now 0.87, as stated above. Competent statisticians, however, doubt whether the increase is real or only apparent, and partly due to more accurate diagnosis and to a greater tendency to seek medical advice. During the last two or three decades surgery has made

enormous strides, and it may be said that no region of the body is now beyond surgical interference. Many more obscure conditions, therefore, come under observation than formerly, and the vast majority of tumours removed by the surgeon are in the present day examined microscopically and their nature ascertained without doubt. In the Registrar General's Report for 1903 (p. 63), the various corrections which have to be made to obtain even an approximate corrected rate will be found. It is also to be noted that the deaths classed under "ill-defined causes," which doubtless included many cases of obscure malignant disease, have steadily fallen. Of 49,555 deaths from ill-defined causes in 1903, further inquiry showed that 439 were due to malignant disease. If these inquiries had not been made, which was formerly the case, these 439 deaths would have been omitted, and the cancer death-rate would have been correspondingly diminished. The statement is definitely made in the report of the Imperial Cancer Research Fund just issued that it is not yet possible to determine statistically whether cancer has really increased.

Cancer attacks rich and poor alike, and the manner in which it progresses to a fatal issue, unless early treated by radical operation, has caused it to be regarded with dread by all. It attacks all races of men, though the savage races seem less susceptible than the civilised, and it is met with throughout the vertebrate kingdom. There is no evidence that any form of diet or mode of life conduces to cancer-formation. The origin of cancer has for long exercised the minds of pathologists, and it is in particular the true cancers or epithelial tumours which have been the subject of most research.

The alleged causes of the origin of cancer may be divided into entogenous or intrinsic, spontaneous and anomalous changes within the organism, and ectogenous or extrinsic, derived from outside the body. Of the entogenous theories the most important are those of Thiersch and of Cohnheim. Thiersch suggested that tumour formation consisted in a loss of balance between the epithelial cells and connective tissue, whereby the former take on abnormal and undirected growth. Cohnheim referred the origin of cancer to embryonic cells which had for some unknown reason remained in an undeveloped state and become included in the tissues, and which subsequently proliferate and form the primary growth. Ectogenous theories ascribe the formation of malignant growths to the action of micro-parasites, and bacteria, yeast and other fungi, and protozoa have in turn been regarded as the causative organisms. There are, it is true, some analogies between certain microbic conditions and cancer formation, but the fact that it is a portion of the original growth conveyed by the blood and lymph to distant parts which causes the secondary growths, and that the tissues at the site of the secondary growth take no part in its formation, is quite different from what obtains in microbial affections. Attempts have been made to prove that cancer is contagious, and it is known that the disease is more prevalent in certain districts than in others, which lends some support to the parasitic theory. Auto-infection undoubtedly occurs; a cancer of the breast may infect the neighbouring arm, or of a lip the other lip, and cancer of mice can readily be inoculated into other mice, but these instances of apparent inoculation are rather of the nature of a transplantation; in the mouse it is the tissue introduced which increases and forms the malignant growth, not the tissue of the inoculated animal. Experiments by the staff of the Imperial Cancer Research Fund prove that healthy mice kept in close contact with cancerous mice never contract the disease.

The cancer of one animal is inoculable only into another animal of the same species, and human cancer, therefore, cannot be transmitted to the lower animals. All attempts to isolate a micro-parasite have proved failures, in spite of the vast amount of work done in this direction. The alleged organisms of cancer, such, for example, as certain yeast fungi, have, it is true, been found to produce tumour-like growths, but these have, on critical examination, been proved to be of the nature of granulomatous growths, and not true cancer. A point of which a good deal has been made by the supporters of the parasitic theory is that the so-called "cancer bodies," the alleged parasites, are present only in malignant growths, and not in normal or pathological tissue nor in benign tumours. But the deduction from this fact, that these bodies are therefore parasitic, has little to support it when it is considered that cancer is a unique tissue, and might obviously contain structures not found elsewhere and not necessarily parasitic. On these and other grounds the parasitic theory has of late steadily been losing ground.

The remarkable observations of Prof. Farmer and Messrs. Moore and Walker have recently thrown much light on the possible nature of the cancer process. As detailed in these columns (February 4, 1904, p. 319), it is found that in cancerous tissues many at least of the cells divide in a manner quite different from that of the somatic or body cells generally. This mode of cell-division observed in cancer is that which obtains in gametogenic or sexual reproductive tissue, and is characterised by a difference in the mode of division (transverse instead of longitudinal) and in the number (sixteen instead of thirty-two for man) of the chromatin bands or chromosomes of the nucleus, and is known as "heterotype mitosis." The division succeeding the heterotype, known as the homotype, still retains the reduced number of chromosomes, and is, therefore, sometimes termed "reduction division." Cells with reduction division do not seem to be able to regain the somatic mitosis except by fertilisation. This gametogenic-like tissue of malignant growths has been termed "gametoid." Other irregularities in division of cancerous cells also occur.

Another remarkable fact recently demonstrated by Messrs. Farmer, Moore, and Walker (NATURE, June 15, p. 164) is that in the normal reproductive tissues structures occur which are strikingly similar to the bodies ("cancer bodies") described by Ruffer, Plimmer, and others in cancerous growths, and regarded by many as parasites. These structures in the reproductive tissues are the archoplastic vesicles, and that similar structures should occur in cancerous growths (and not, be it noted, in benign tumours) on the one hand lends additional support to the idea of the gametoid nature of the cancer cells, and on the other further disproves the supposed parasitic nature of the "cancer bodies."

Is it possible from these observations to formulate a suggestion as to the nature of the cancer process? Prof. Farmer himself has stated that he and his coworkers do not profess to explain the relation between the heterotype mitosis of the gametoid cells of cancer and the life-history of cancer. It might be that the gametoid cells of the malignant growth undergo some process of fertilisation giving rise to an aberrant embryo, as it were, which by development forms the primary growth, which would thus be parasitic on the host, the secondary growths arising from a repetition of the primary event. In some plants gametogenic tissue may normally possess parasitic characteristics. There is, however, so far little evidence of fertilisation or fusion of the gametoid cells in cancer,

except that, as recently stated by Mr. Moore (*Brit. Med. Journ.*, July 8, p. 104), leucocytes or white blood cells are sometimes found within the body of the cancer cells, with which they appear to be undergoing conjugation.

Messrs, Farmer, Moore, and Walker suggest that it is possible that the malignant elements are the outcome of a phylogenetic reversion, but this would not necessarily explain the *invasiveness* of cancer. In spite of recent work, much remains to be done and to be explained before we shall be in a position clearly to understand the cancer process.

With regard to the causes which lead to the production of the gametoid cells in cancer, it has been found that in plants various stimuli will rapidly bring about heterotype mitosis, and, given the proper stimulus, probably any somatic cell may become changed into this type. The connection between chronic irritation and cancer has long been recognised, but the manner in which this factor acts to produce cancer has not been understood; but in the light of the foregoing, it may be regarded as one of the stimuli which may bring about heterotype mitosis and reduction division.

Does recent work hold out a prospect of the discovery of a curative agent for cancer? It cannot be said that our hopes in this direction have been materially increased as yet. At present almost the only hope of cure lies in early and radical operation, and it is of the greatest moment that the public should realise the importance of early treatment, and that no time should be lost in seeking advice. In superficial cancers, the X-rays and radium emanations seem to effect a cure by causing a retrogression or a necrosis of the cancer elements. Possibly the gametoid tissue of the cancer is more vulnerable than the somatic cells, and hence the former may be caused to degenerate or be destroyed without materially injuring the latter, but probably the rays cause proliferation of the connective tissue elements of the growth and interfere with its nutrition. Is it possible that the stimulus of these rays may also act like fertilisation, and causes the gametoid once more to revert to somatic cells, which then being of the nature of a foreign body are partly removed and partly remain inert?

Clowes and Gaylord (Bulletin of the Johns Hopkins Hospital, April, 1905) have observed that cancer in mice occasionally undergoes spontaneous retrogression and cure, and the same occurs, but, unfortunately, only too rarely, in human cancer. Clowes found that the blood serum of the mice in which this spontaneous cure had occurred exerted a marked curative action on other mice suffering from the disease. This suggests the possibility that work of a similar nature may eventually lead to the discovery of a means of treating human cancer, but the probability is small, for it is extremely unlikely that the serum of any animal would have the slightest effect on the human being. A spontaneously cured human being would almost certainly have to provide the serum!

R. T. HEWLETT.

BRITISH FRUIT GROWING.

THE report to the Board of Agriculture of the departmental committee appointed to consider what measures can be taken for the promotion and encouragement of fruit culture in these islands has been issued. The commissioners recommend that a special department should be formed to deal with matters relating to the fruit industry, and that this department should be subdivided into (*a*) a bureau of information; (*b*) an experimental fruit farm. The desirability of encouraging the practice of gardening in schools in the rural districts is also alluded to, and this recommendation will be generally concurred in. Legal questions connected with the tenancy and rating of land used in fruit culture are of cardinal importance, as also are those relating to the carriage of fruit by rail and to the alleged unfair treatment by the companies of the home-grower as compared with his foreign competitor. The necessity of further market accommodation is likewise insisted on.

These are all matters of importance, but they do not cover the whole of the ground. We find no reference in the report before us of the influence of the weather on the fruit crops, and yet this is a factor the potency of which outweighs all others. In the case of hardy fruits, not grown under glass, the fruit grower is in the main powerless to contend against adverse conditions. The tabulated reports from every county in the British Islands, which have been published annually for the last forty or fifty years in the *Gardeners' Chronicle*, bear ample testimony to this. Spring frosts when the trees are in blossom occur more or less every year, and when they happen to be severe, as they were this year, the results are disastrous. The reports from the cherry-growing districts of Kent this year show remarkable diversity of yield from farms in the same neighbourhood, a diversity due presumably to differences of shelter and aspect. It is difficult to see how the grower can protect himself from these adverse conditions. Experimental farms such as are recommended by the commission, and of which one is in operation at Woburn under the auspices of the Duke of Bedford, are for the most part of local value only; the lessons they teach may not be applicable in the next parish where the conditions are different.

Can nothing, therefore, be done? We should be sorry to assent to such a proposition. We believe that something could be done. But then arises the question whether, in the face of the vast importations first from the American continent, and when supplies from that quarter are exhausted, from Tasmania and Australia, any steps which the British grower could take would be of any use, commercially speaking? Again, no competition on the part of the home-grower is possible with the banana imports from the Canaries and the West Indian islands, which are assuming such vast proportions, or with the still larger importations of oranges. The case is different when what are termed soft fruits are concerned. We can hold our own with strawberries, raspberries, and currants, whilst gooseberries, especially when picked in a green condition, are among the most profitable crops that a farmer or even a cottager can grow. Spring frosts do them relatively little harm, so that a crop of some sort can generally be relied on.

From a commercial standpoint, when we talk of our home fruit-crops we mean apples or plums, and reverting to the subject of spring frosts we may well inquire whether it is not possible for our experts to raise breeds which shall be immune from injury. Our American cousins hoped for great things by the introduction of Russian apples, and some were tried here also, but the results were not encouraging, as the quality of the fruit was so indifferent that the experiment was not continued. Another lesson from the same source seems more promising. When a few years ago a "big freeze" occurred in Florida, the orange plantations suffered exceedingly. What did our friends do? Did they abuse the fickleness of their climate and take their misfortunes with the resignation of the fatalists? Not so. They set to work without loss of time to raise by means of cross-breeding a hardy variety, and they have at least made a good beginning. So, too, have our friends the